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on the 1st instant, at West Philadelphia, in the 62d year of his age, was announced by Mr. Fraley, with appropriate remarks. On motion, Mr. Solomon W. Roberts was appointed to prepare an obituary notice of the deceased.

The Committee to which was referred the paper and map of Mr. Lyman, on the Punjaub Oil Region, reported in favor of its publication in the Transactions.

Mr. Lyman exhibited a large map of the region between Rawul Pindee and the Salt Range, published by the British Government, and described the zoological structure and mineralogy of the country.

Dr. G. B. Wood, referring to his previous communications of the use of potash salts in agriculture, made some additional remarks on that subject.

Professor Cope offered for publication in the Proceedings a paper on "The Families of Fishes of the Cretaceous Formation of Kansas."

Pending nominations Nos. 689, 690 and 691 were read, and the meeting was adjourned.

Influence of Fresh Wood-Ashes on the Growth of Wheat, Potatoes, &c.

BY DR. GEORGE B. WOOD.

(Read before the American Philosophical Society, February 2d, 1872.)

In a communication made to the Society at their meeting of January 6th, 1871, in relation to the efficiency of fresh wood-ashes in the revival of prematurely failing fruit-trees, I took occasion to suggest that, upon the same principles, they might prove equally efficacious in preventing the failure or deficiency of the wheat crop, so common of late in the old settled parts of our country. The opinion was based on the large proportion of potassa found in the ashes of the wheat plant, when burned in the growing state; exceeding as it does twenty times that of common unleached ashes. Wheat, therefore, requires a very large relative proportion of the alkali for its growth, more than can be derived from an exhausted soil, even when aided by manure, which, though it contains a considerable quantity of the salts of potassa, cannot yield enough to the growing wheat to insure a large crop. But this was mere speculation, and the question could be decided only by experiment. Accordingly, as stated in my last communication, I selected an acre of ground, and dividing it into three parts, treated one with ashes alone, another with ashes

and swamp-muck conjointly, and the third with muck alone; the muck being applied as ordinary manure, and the ashes sprinkled upon the ploughed ground at the same time with the sowing of the wheat, and then harrowed in along with it. This was done early in the autumn of 1870. Even during the same season, the eye could readily perceive the more luxuriant growth of the wheat where supplied with ashes, and a line of division between this portion of the lot, and that simply manured, was very obvious. But the point in question could not be decided until harvest time next year. Unfortunately, circumstances prevented me from being present at that time, and I had to depend for the result upon the report of my agent, in whom, however, I have great confidence. He reported that he gathered the wheat from small and perfectly equal portions of the two divisions, of which one had, and the other had not been ashed; finding no such difference between the two ashed portions as to render it worth while to distinguish them. On separating and measuring the wheat, he found that the quantity from the ground where the ashes were used was about double that from the part which had been supplied with muck alone, and, in relation to general productiveness, was in the proportion of about 27 bushels to the acre, far exceeding the ordinary crop, which, though under peculiarly favorable circumstances, it may sometimes equal 20 bushels to the acre, does not often, according to my experience and observation, exceed 12 or 15 bushels. It should be mentioned that the ground on which the experiment was made was of nearly equal quality throughout, and very poor.

But I have to mention a fact connected with these proceedings, which goes still further than anything yet said to prove the efficacy of potash in the wheat culture. The common poke is a plant abounding in the salts of potassa, and, therefore, selects for its own growth new and rich soils, which have not yet been exhausted by cultivation. Upon the heaps of swamp muck, thrown up on the borders of cranberry meadows in the process of their preparation, the poke springs up very rapidly and copiously, so as in a short time to completely cover the heaps; and the eye at once recognizes a muck bed by this luxuriant covering. By gathering and burning this copious crop, we obtained a quantity of ashes remarkably rich in potassa, containing at least 45 parts of the alkali in 1000 of the ashes, and therefore very nearly equaling in this respect the growing wheat. To test the quality of some ashes thus obtained, we substituted it for the common wood ashes in a small space of that division of the ground which was treated with this material. Within this small space the wheat grew most luxuriantly, with stems higher and stronger, and heads longer and fuller than those of the plant in other parts of the lot; and, when the crop was gathered, the produce was found to be in the proportion of thirty-eight bushels to the acre, exceeding by more than one-third that obtained under ordinary wood-ashes. As the proportion of the alkali in the two kinds of ashes used was the only point in which they materially differed, the necessary inference is that the difference in the amount of product was owing exclusively to

the much greater proportion of potassa in the poke-ashes, which exceeded by more than 20 times that of the wood-ashes; and further, that all the effects of ashes in promoting the growth of wheat are ascribable to the alkali contained in them.

These experiments were made on too small a scale, and with too little precision in quantity and measurement, to authorize any very exact conclusion as to the effect of ashes upon growing wheat; but they are sufficient, I think, to prove that the effect is very great, and that the farmer may have recourse, with great hopes of advantage, to this agent, if attainable at a suitable price. If the plan be generally adopted, the ashes would soon fail; but I have no doubt that commercial potash might be substituted for them, with at least equal effect; one pound of it being equivalent, I presume, to about a bushel of the best wood-ashes. Should the supply of commercial potash fail, recourse may be had to the alkali as now procured from mineral sources, which will probably prove inexhaustible.

A few remarks on the mode of using the ashes, or their alkaline substitute, for the promotion of the wheat crop, may be acceptable to those who, without previous experience, may be disposed to try the measure.

When leached ashes have been used as a dressing for wheat, for which experience has long showed that they are among the best fertilizers, they have been applied in the same manner as ordinary manure; being first spread upon the surface, and then turned under by ploughing. This method is correct; because the very small proportion of potassa contained in leached ashes is in the form of the insoluble silicate, which cannot be dissolved or carried away by the rains, but which is probably slowly converted, as wanted, into the soluble carbonate by the influence of the root-lets, which then absorb it. The unleached ashes, containing the alkali in a soluble state, cannot be treated in the same manner; as their alkali would be dissolved by the rain, and carried away, in great measure beyond the reach of the roots. I have, therefore, caused the ashes to be sprinkled or otherwise spread, as equally as possible, over the surface of the ploughed ground at the same time that the wheat is sowed, and the two then to be harrowed in together. The grain is thus brought into contact with the ashes, and, when the alkali is dissolved out, is ready to appropriate it to its own development. But as all the unappropriated alkali is probably dissolved out, and carried away by the winter rains, I direct that, in the early spring, another coating of ashes should be sprinkled over the young wheat, so as to yield it a supply of the alkali during the growing period.

The same plan, essentially, should be followed in the use of commercial potash. Being extremely soluble, it should first be dissolved in water, and the solution then sprinkled over the ploughed ground at the sowing of the wheat, and again in the early spring upon the crop as it is beginning to grow.

As to the precise quantity of ashes or of commercial potash to be

used, in proportion to the extent of ground, I am not prepared to say ; but I believe that I have employed from 25 to 50 bushels of the fresh wood-ashes to the acre. I have no doubt, however, that this quantity might be greatly exceeded, not only safely but with advantage ; as shown by the effects, before mentioned, of the poke ashes, which must have been equivalent in alkaline strength to at least 20 times the quantity of common unleached ashes.

Every farmer, in whose family the ashes are lixiviated for the preparation of soft soap, has it in his power to make a little experiment, the result of which may determine his future course. Let him beg from the women a bucket full of lye, and, after sowing his wheat in the autumn, let him, by means of a tin watering can with perforated spout, sprinkle the liquid equally over a small portion of the field, and repeat the process upon the same plot of ground when the wheat begins to resume its growth in the spring. If he find the product of the small plot thus treated greatly in excess of the average of the field, he may gain confidence to proceed on a larger scale, and thus perhaps, materially advance his income.

Within about a year, my attention has been attracted to the potato crop, with reference to the use of fresh ashes in its cultivation, and I have little doubt that the same treatment may be applied to this as to the wheat, with at least equal advantage. On consulting the chemical authorities, I found that the stems and leaves of the common Irish potato are even richer than the wheat plant in the salts of potassa ; their ashes containing 55 parts of potassa in the 1000, while the proportion of wheat is only 47. Now the potato crop has of late years, in my neighborhood, been much more uncertain than formerly ; even, I think, independently of the disease which has from time to time made so much havoc with this crop. It is highly probable that the cause, as in the case of fruit trees, may be a deficiency in the supply of potassa, and it is not impossible that the disease which is believed to have its origin in a microscopic fungus, may, like the worm at the root of the peach, depend upon the deprivation of the alkali, which may be necessary to the protection of the plant against these low parasites. To determine this point, as far as a single observation could do so, I had a quantity of potatoes planted last spring in rows, a certain number of which were supplied with fresh ashes in the hills, while the remainder were treated only with manure. In the rows in which ashes were used, the plant grew much more vigorously than in the others, and the product in potatoes was, I believe, about double ; though I cannot recall the precise figure, in this case.

I have under way, this season, an experiment on the application of fresh ashes to the wheat crop on a much larger scale than the first ; and my intention is to pursue a similar plan with the potato, at the time of planting in the spring. Should I be spared to see the results of these trials, I hope to be able to present a statement about them to the Society. Should the opportunity offer, I intend also to try how facts will support my

supposition, in relation to the use of common potash as a substitute for ashes.

I cannot close this communication without referring to the original subject of the revival of prematurely failing peach trees. I have continued to apply ashes in the same manner as at first, in the autumn or spring, or both, to the different kinds of fruit trees; and, I believe, with uniformly favorable results. The peach orchard, which, four years ago, appeared to be in a dying state, and had for several seasons ceased to bear fruit, is now in a vigorous state, and last summer yielded a copious crop. The old apple orchard, which was so wonderfully revived two years since, continues apparently, except in the case of a few trees dying from old age, to hold all that it had gained, though we lost the crop last year through the destruction of the blossoms by a late frost. The pears and quinces of which the blossoming period differed from that of the apple, so that they escaped the frost, were full of fruit; and I was particularly struck with one old quince tree, which, before the use of ashes had borne scanty crops of a small, imperfect, knotty fruit, but, last year, under the influence of ashes, was loaded with smooth and well formed quinces.

I have not yet been able to form any positive conclusion in relation to the protective effect of fresh ashes against the curculio in the plum tree; but I am prosecuting some inquiries in this direction, and hope before long to be able to solve the question either favorably or unfavorably. I must confess, however, that I am by no means sanguine of the former result.

ON THE FAMILIES OF FISHES OF THE CRETACEOUS FORMATION OF KANSAS.

By E. D. COPE.

(*Read before the American Philosophical Society, January 5th, 1872.*)

SAURODONTIDÆ.

Cope. Proc. Amer. Philos. Soc., 1870, p. 529. Hayden's Survey, Wyoming, etc., 1871, p. 414.

A considerable accession of material belonging to several species of this family, furnishes important additions to our knowledge of their structure, and enables me to determine their affinities with more precision than heretofore. The results are of value to the student of comparative anatomy, and also to the palæontologist, as they appear to have been the predominant type of marine fishes, during the cretaceous period, in the North American seas, and to have been abundant in those of Europe.

The characters already assigned to the family are confirmed by the new species discovered, and many additional ones added, as follows:

The cranial structure cannot be fully made out, but the following points may be regarded as ascertained: The *brain case* is not continued between the orbits, and the *basis cranii* is double and with the muscular tube